



BERKELEY LAB
LAWRENCE BERKELEY NATIONAL LABORATORY



U.S. DEPARTMENT OF
ENERGY

Open Source LLRF Stack

C. Serrano

LLRF'19 Workshop

Story



My first LLRF Workshop (2007)



Community



”A feeling of fellowship with others, as a result of sharing common **attitudes, interests, and goals**”

You and your research



Richard Hamming

Why Open Source?



A statement on the **attitude** question. Letting you **see** what we do and hope we can share our **interests** and achieve our **goals**, together.

DOE Lab tour



Office of Science Laboratories

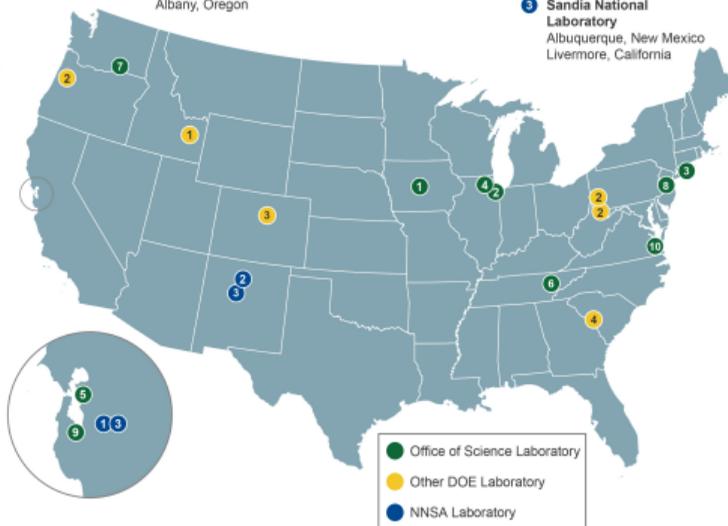
- 1 Ames Laboratory
Ames, Iowa
- 2 Argonne National Laboratory
Argonne, Illinois
- 3 Brookhaven National Laboratory
Upton, New York
- 4 Fermi National Accelerator Laboratory
Batavia, Illinois
- 5 Lawrence Berkeley National Laboratory
Berkeley, California
- 6 Oak Ridge National Laboratory
Oak Ridge, Tennessee
- 7 Pacific Northwest National Laboratory
Richland, Washington
- 8 Princeton Plasma Physics Laboratory
Princeton, New Jersey
- 9 SLAC National Accelerator Laboratory
Menlo Park, California
- 10 Thomas Jefferson National Accelerator Facility
Newport News, Virginia

Other DOE Laboratories

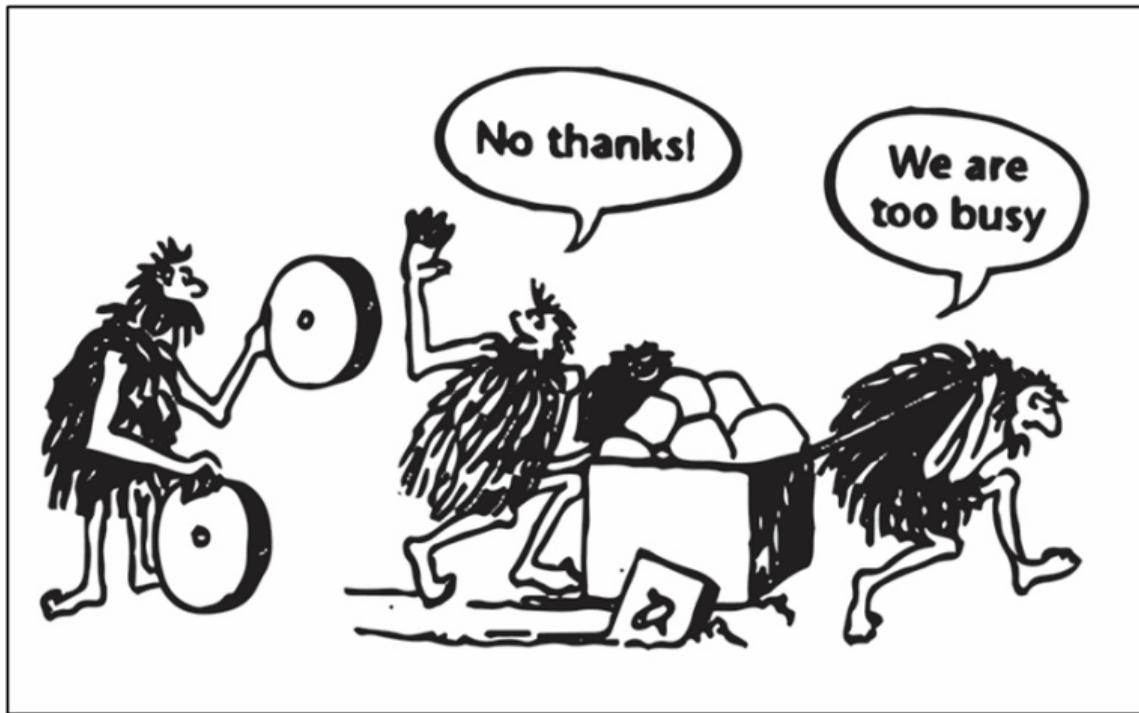
- 1 Idaho National Laboratory
Idaho Falls, Idaho
- 2 National Energy Technology Laboratory
Morgantown, West Virginia
Pittsburgh, Pennsylvania
Albany, Oregon
- 3 National Renewable Energy Laboratory
Golden, Colorado
- 4 Savannah River National Laboratory
Aiken, South Carolina

NNSA Laboratories

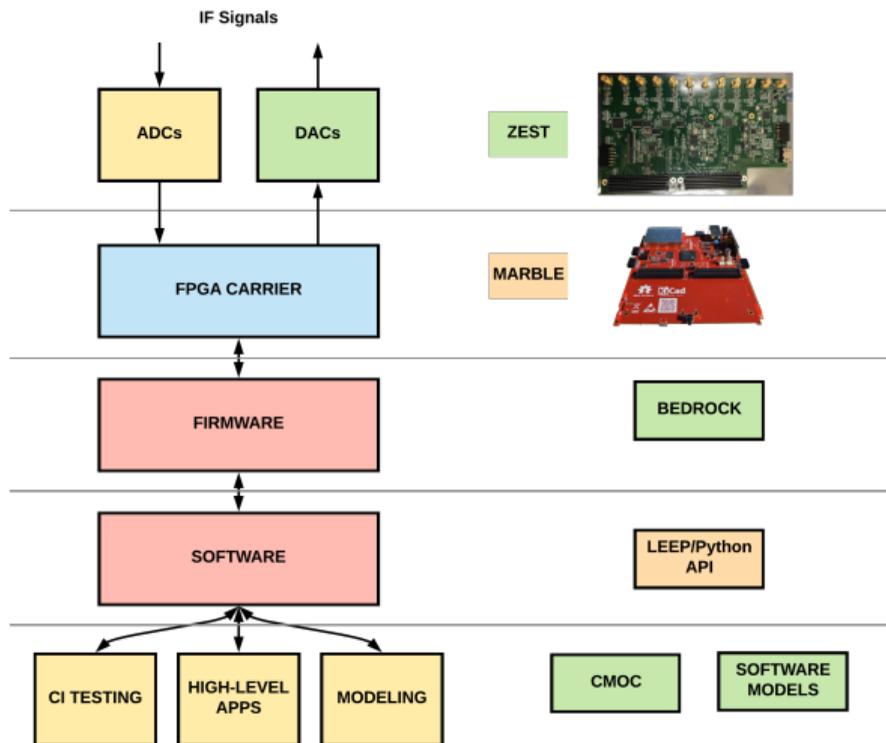
- 1 Lawrence Livermore National Laboratory
Livermore, California
- 2 Los Alamos National Laboratory
Los Alamos, New Mexico
- 3 Sandia National Laboratory
Albuquerque, New Mexico
Livermore, California



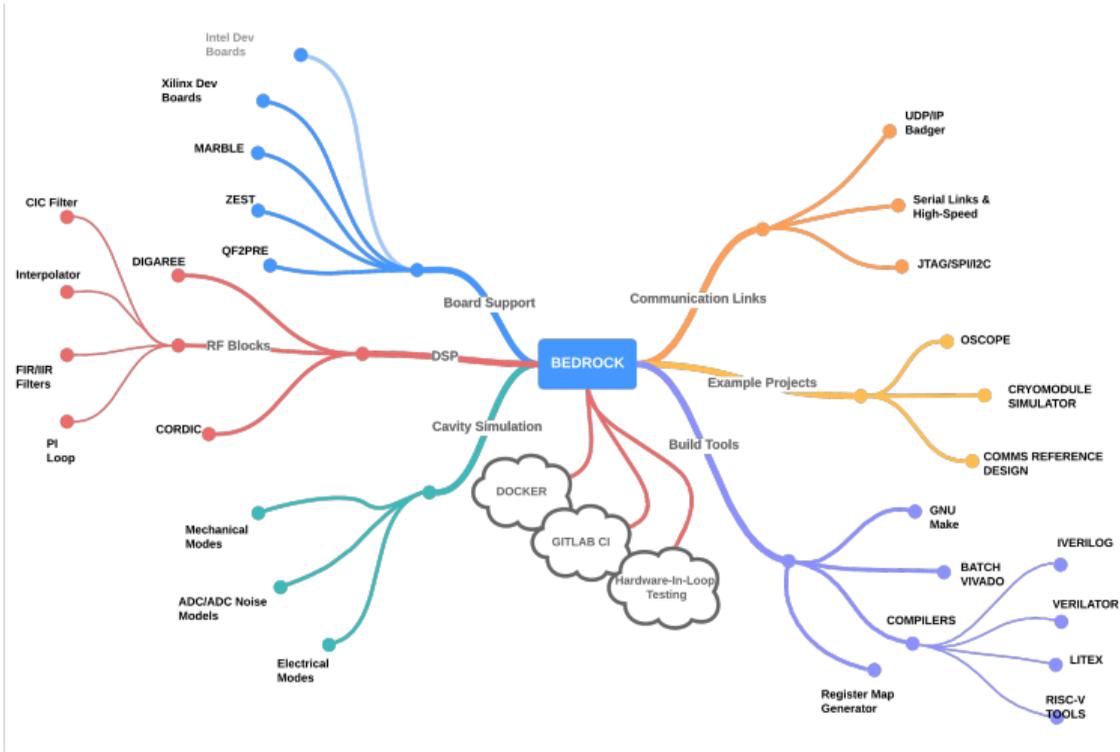
Very productive visits & discussions



Open Source LLRF Stack

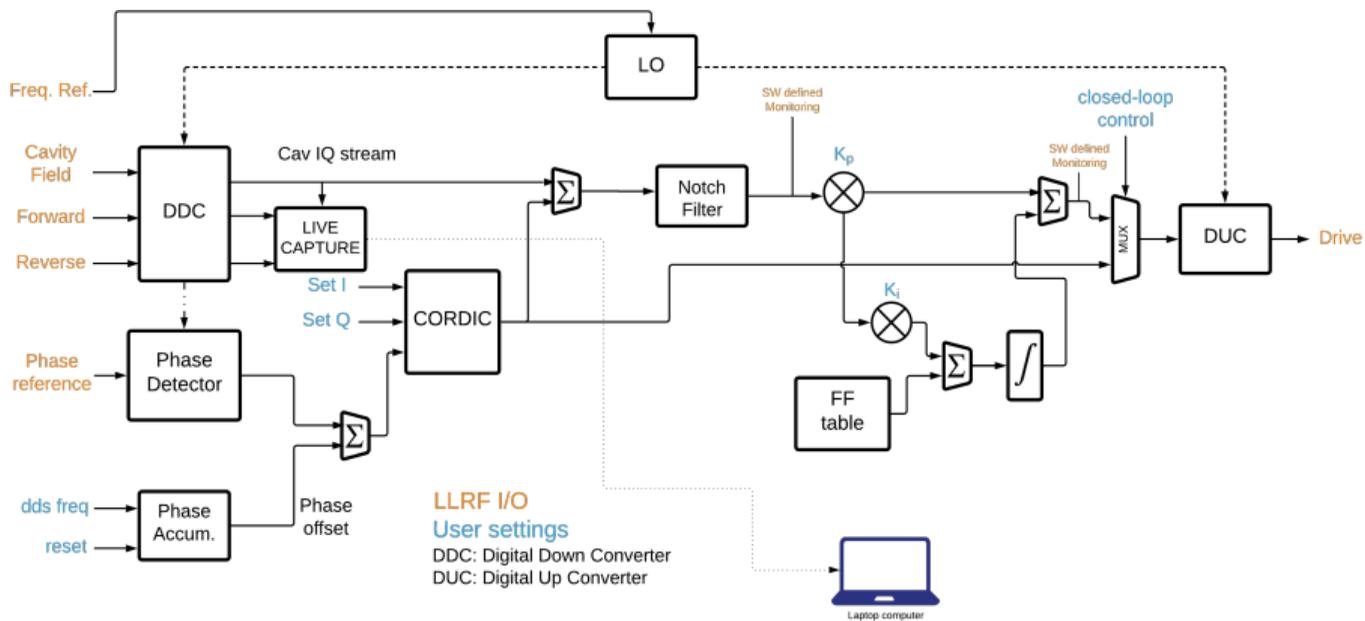


Bedrock

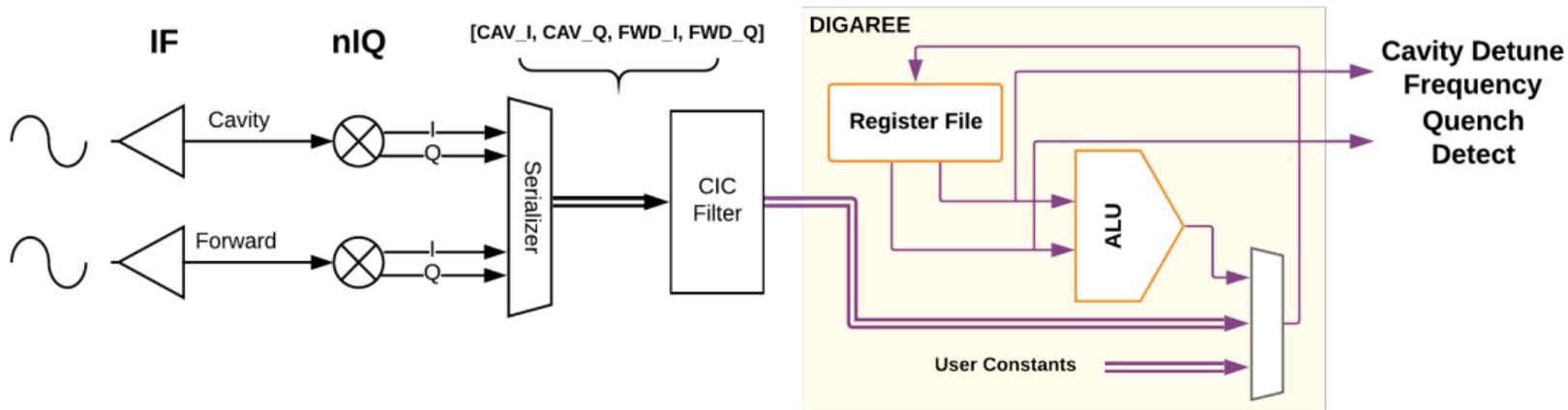


"Honey, you are the rock, Upon which I stand" - Coldplay

RF Controls

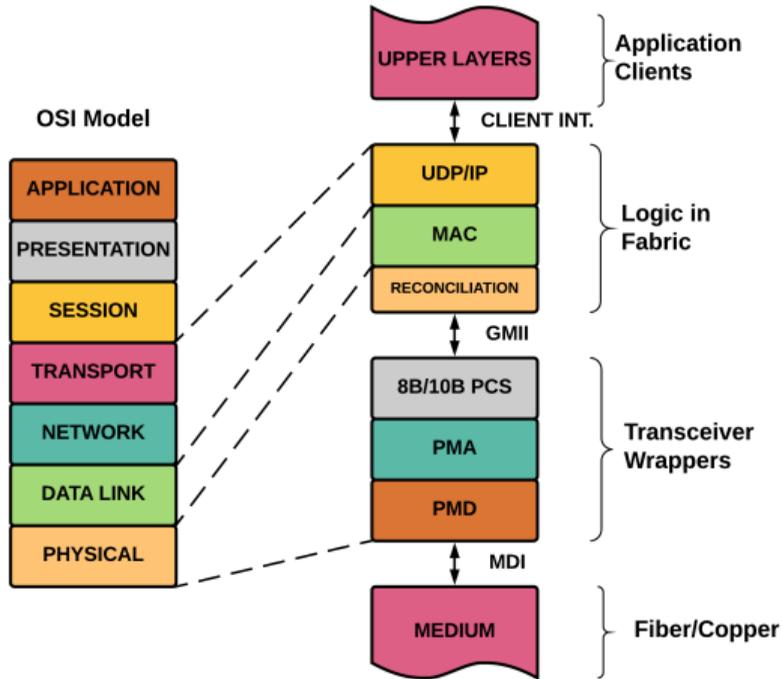


Real-time SRF Analyzer

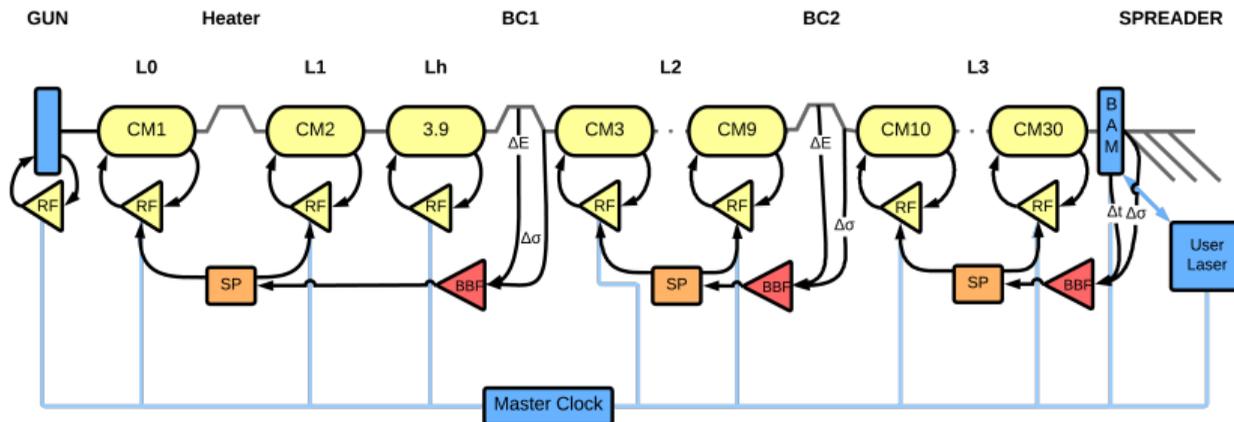


We call it Digaree

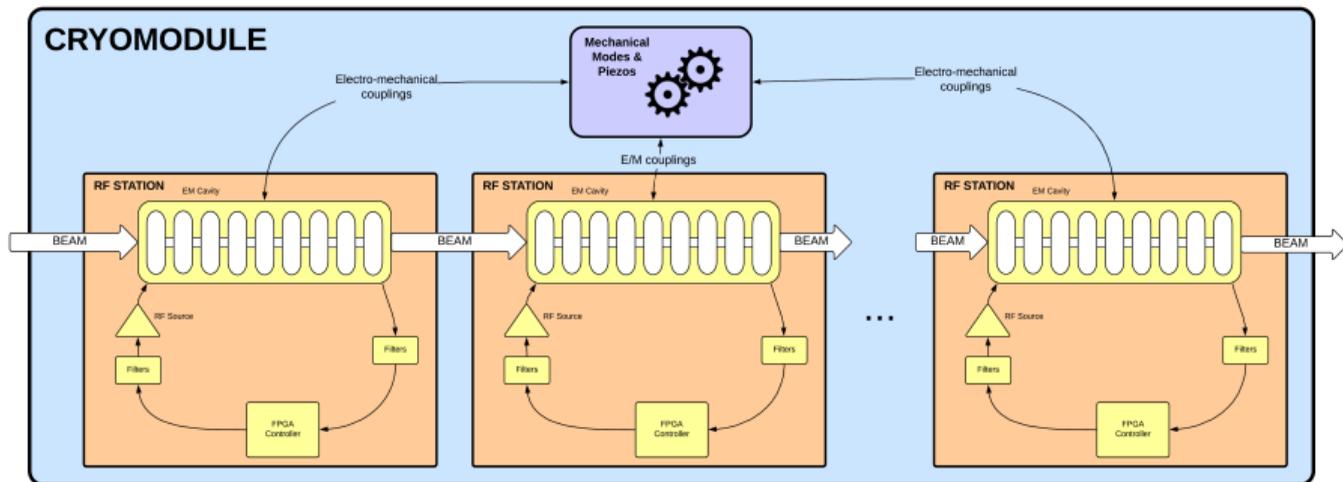
Ethernet in fabric: Packet Badger



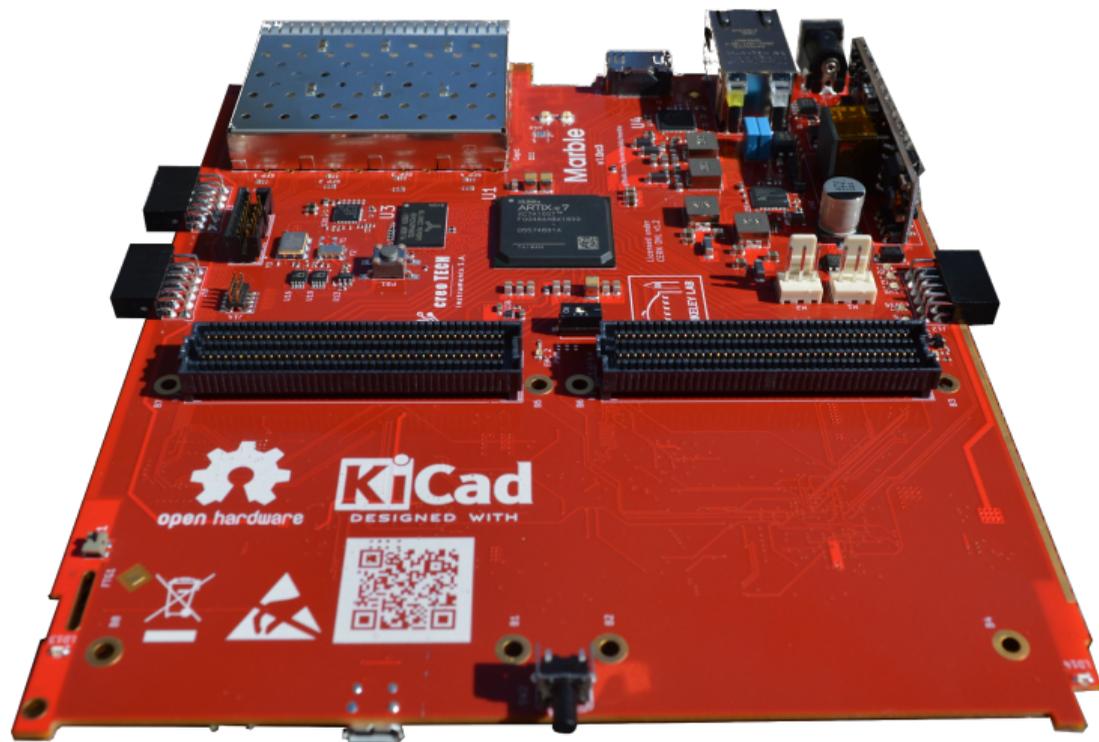
Software Simulation Engine



FPGA Simulation Engine (CMOC)

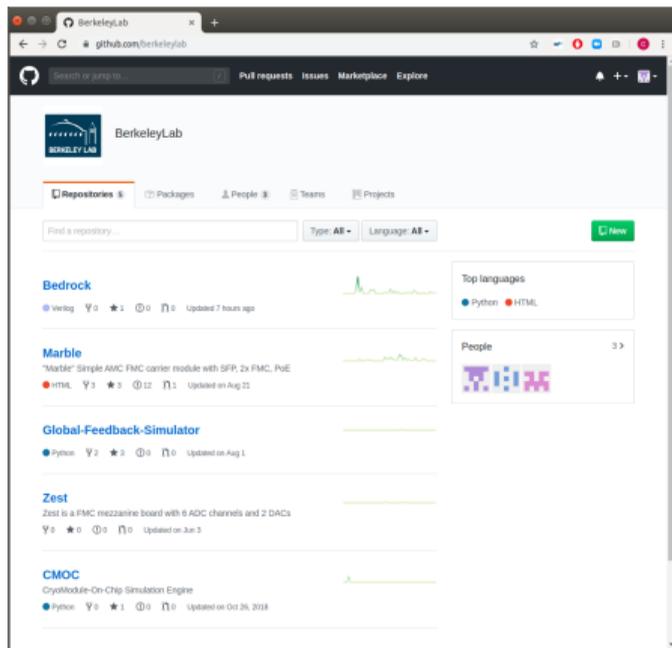


Marble-mini





G. Huang et. al., "Low Noise Digitizer Design for LCLS-II LLRF", NAPAC'16



<https://github.com/BerkeleyLab>

Where is this all used?



ALS



ALS-U



LCLS-II



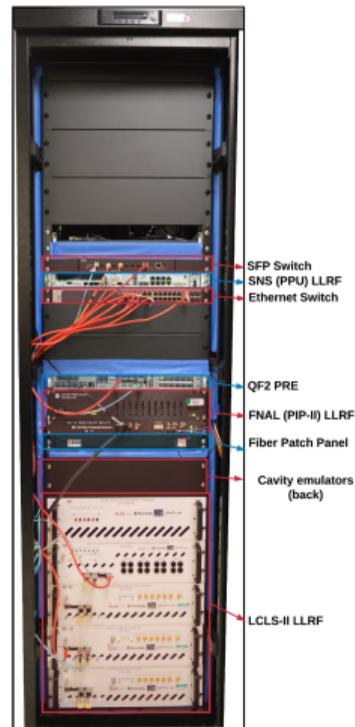
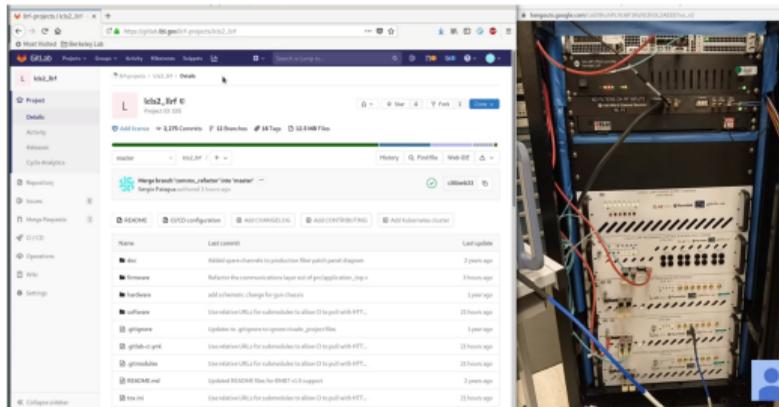
SNS & PPU



PIP-II



How does it all come together?





Those who don't think about the **future**
Resolve the present
With tools from the past.